

reticulate, being either minutely warted or spinulose. Species of *Perichaena*, however, have a two-layered peridium and the sporangia, while they may be clustered, are never heaped. *Calonema luteolum* is similar to the genera *Calonema* and *Oligonema* in that in both of these genera the peridium is single, membranous and often iridescent and the sporangia can be heaped. It differs from these genera, however, in that their capillitium often has spiral markings and the spores are reticulate, while *C. luteolum* has a smooth capillitium and spinulose spores.

The problem arises in deciding which characteristics are the most important taxonomically, or, which characteristics are the most important in showing phylogenetic relationships, I believe the presence of a single peridium and heaped sporangia indicate that the affinities of *C. luteolum* are with *Calonema* and *Oligonema* even though the capillitial and spore characteristics are reminiscent of the genus *Perichaena*. Perhaps this is one area in which cultural studies can be of immense importance in determining evolutionary relationships.

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## A NEW CAMPANULA FROM NORTHERN CALIFORNIA

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An undescribed *Campanula* has turned up in area where one would not have expected to find a new species of flowering plants—Castle Crags, the spectacular and conspicuous mass of spires and domes which rises 4,000 ft. above the Sacramento River southwest of Dunsmuir. A trail in Castle Crags State Park leads up to and among the granitic pinnacles where the *Campanula* grows fairly abundantly in the crevices of sloping and even vertical walls. The plant was first collected in 1948 by the late Freed Hoffman whose private herbarium was given to the University of California. The specimen, identified as *C. scabrella*, came to my attention in connection with a review of the genus *Campanula* in California. I am pleased to name this plant for Stanwyn G. Shetler of the Smithsonian Institution, Washington, D.C., student of *Campanula* and author of a useful conspectus of the genus in North America.

***Campanula shetleri*** Heckard, sp. nov. Fig. 1. Herba perennis rosulata dense caespitosa tota scabro-hispidula; folia breve spatulata paribus dentium oppositorum duobus instructa; caules floriferi 2–5 cm alti,

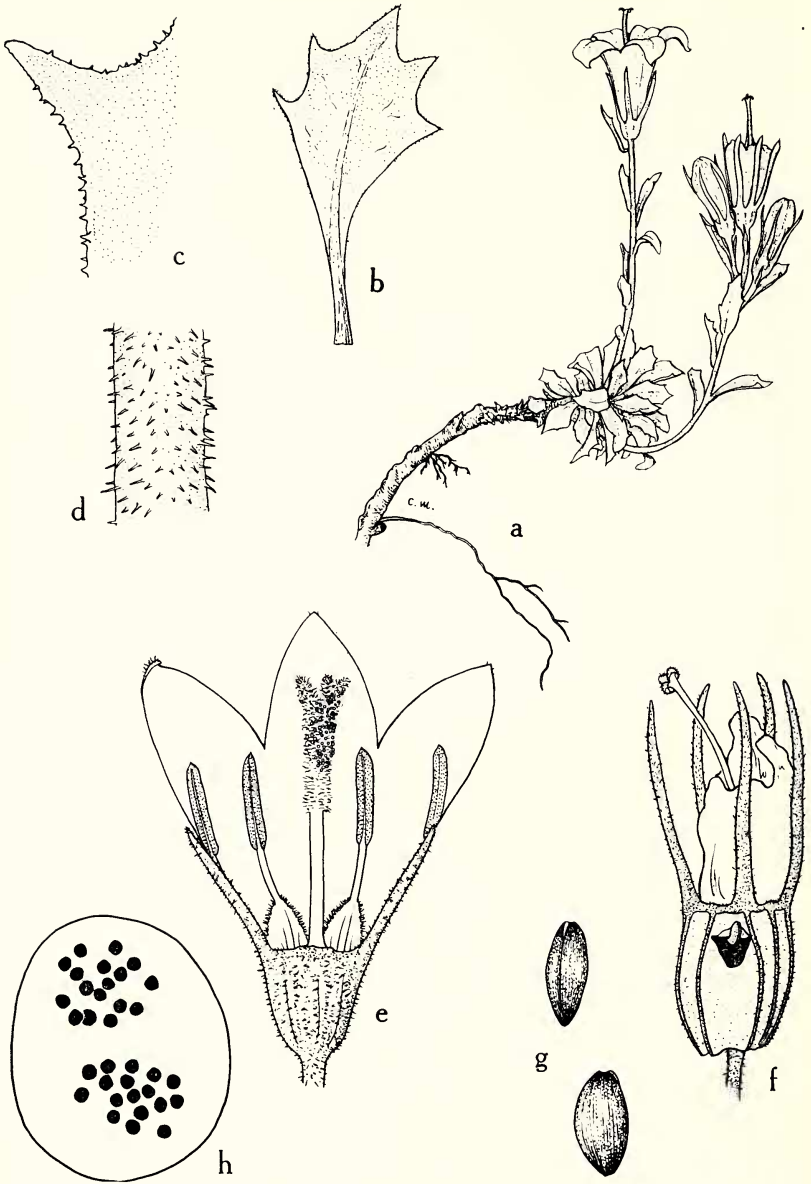


FIG. 1. *Campanula shetleri*: a, habit,  $\times 1\frac{1}{2}$ ; b, rosette leaf,  $\times 3$ ; c, detail of leaf lobe,  $\times 10$ ; d, detail of peduncle,  $\times 20$ ; e, flower,  $\times 5$ ; f, flower at fruiting stage showing the pore of dehiscence,  $\times 5$ ; g, seed,  $\times 15$ ; h, meiotic chromosomes (camera lucida of MII, Heckard 1524),  $n = 17$ , ca.  $\times 1300$ . (Voucher specimens for the drawings: a-e, Heckard 1524; f,g, Heckard 1731).

inflorescentiis 1-5-floribus terminantes; corolla infundibuliformis 9-10.5 mm longa, ore similiter lata lobis eius ovato-deltaoideis 4.5-5 mm longis, quam tubo leviter brevioribus; hypanthium cupulatum super medium latissimum lobis eius integris subulatis; capsulae pori in partem eius super medium collocati.

Mat-forming perennial with densely clustered rosulate shoots arising from long and slender, sparingly branched underground stems with adventitious roots arising singly or in clusters in axillary regions where the inflorescence-branches have abscised; rosettes with loose to dense clusters of spirally arranged leaves, the stem clothed below for varying distances with withered leaves or leaf-bases, some rosettes giving rise in the leaf-axils to 1 to 3 flowering shoots; rosette-leaves scabrous-hispidulous throughout, the lamina short-spatulate (roughly hexagonal), about 6-7 mm long and 4-5 mm broad, with 2 pairs of opposite teeth, the apex cuneate with a sharp to blunt tip, the base also cuneate, tapering gradually into a short petiole 1-2 mm long; flowering shoots ascending to erect, 2-5 cm high, bearing few to ca 15 leaves which are gradually reduced towards the shoot-apex, the herbage scabrous-hispidulous throughout, the cauline trichomes slightly retrorse; inflorescence with one terminal flower or also with 1-2 (4) later-opening flowers each borne on a short pedicel 1-4 mm long, the pedicels axillary in the uppermost leaves (bracts) and bearing usually 2 sub-opposite or 1 subulate bracteole(s) about 2 mm long; calyx-lobes subulate, entire, densely hispidulous, 4-5 mm long in anthesis, lengthening in fruit to 5-6 mm; corolla pale blue to nearly white, glabrous except for a few small pointed trichomes (similar to those of the herbage) on the outer face at the tip of the corolla-lobe, funnellform, 9-10.5 mm long and about as broad distally, the lobes ovate-deltoid and acute, spreading and becoming recurved, 4.5-5 mm long, slightly shorter than the tube; anthers glabrous, narrow-oblong, 2.5-3 mm long; filaments 2-2.5 mm long, the basal portion ovate-deltoid and ciliate, ca. 1.5 mm long, slightly exceeding the linear distal portion; style about as long as the corolla, 7-8 mm long in anthesis, papillose on the upper one-third, the 3 stigmata each 1 mm long, becoming strongly recurved after anthesis; hypanthium cup-shaped (2-2.5 mm in diam.), scabrous-hispidulous throughout, 2-3 mm long and usually slightly narrower, broadest above the middle; capsule erect, broadly to narrowly cylindrical or somewhat urceolate with broadened base, 3-4.5 mm long and 3-4 mm broad, often longer than broad, rounded and irregularly 3-lobed at base, opening just above the middle by three valves; seed just less than 1 mm long, ovoid to ellipsoid with a slight crest, somewhat 3-angled with the 2 broader sides flattened, the third rounded, the seed coat smooth, shining, amber in color; chromosome number:  $n = 17$ .

Holotype. CALIFORNIA. Shasta Co.: Castle Crag State Park, along trail to Castle Dome, ca. 4200 ft; forming mats in cracks of north- and

northeast-facing granite cliffs, *Heckard & Bacigalupi 1524*, 14 June 1966 (JEPS).

Other specimens examined: CALIFORNIA. Shasta Co.: trail to summit of Castle Crags, almost at timber line, *Hoffman 2644* (UC); 0.2 mile south of Castle Dome, 4700 ft., *Heckard 1525, 1731* (JEPS). Siskiyou Co.: north-facing cliffs at Little Castle Lake, ca. 6000 ft., *Roderick, 1 Sept. 1967* (JEPS).

The plants grow in granitic detritus and humus accumulated in the crevices and cracks of steep and even vertical north- and northeast-facing cliffs. Associated crevice-plants are *Penstemon newberryi* ssp. *berrysii*, *Heuchera merriamii*, and *Ivesia gordonii*, while the most common and conspicuous trees and shrubs of the surrounding area are *Pinus ponderosa*, *Quercus chrysolepis*, *Lithocarpus densiflora* var. *echinoides*, and *Arctostaphylos patula*. A few individuals of *Picea breweriana*, a species restricted to the mountains of northern California and southern Oregon, are present. Although *C. shetleri* grows near and above the apparent timberline of Castle Crags, it should be considered a part of the Yellow-Pine Forest community of Munz and Keck (Munz and Keck, 1949; Munz, 1959) since timberline in the crags is probably largely controlled by the granitic substrate and steepness of the topography.

The new species has a known range of less than 4 miles, but it should be looked for on other unexplored granitic peaks in the general region. The limited distribution of *C. shetleri* is not unique in this genus. Shetler (1963) points out that several North American *Campanula* species are highly localized.

Shetler (1963) divides the 16 *Campanula* species restricted to North America into 5 species-groups based on habit and habitat. *Campanula shetleri* has its closest affinity with group 2, the arctic-alpine endemics, consisting of 5 species from western North America. Strictly speaking, the relatively low elevation (4,000–6,000 ft.) occupied by *C. shetleri* would not qualify it as an endemic of the arctic-alpine zone. The addition of *C. shetleri* to the group thus makes the group-name less appropriate. The species most similar to *C. shetleri* is another narrow endemic, *C. piperi* of the Olympic Mountains in Washington, nearly 500 air-miles distant. *Campanula piperi* occupies a rock-crevice habitat similar to that of *C. shetleri* but in the arctic-alpine zone. In general, *C. shetleri* is much smaller in almost all respects than *C. piperi*, a comparison which includes all flower-parts such as anthers, stigmata, and hypanthium. Several additional well-defined morphological differences between the two species are listed in Table 1. Both species have the same chromosome number of  $n = 17$ .

Two other species in the arctic-alpine group, *C. wilkinsiana* and *C. scabrella*, are of some interest because, although rare in California, they occur within a short distance of *C. shetleri* on neighboring mountains.

*Campanula wilkinsiana* is a rather narrow endemic of the Salmon-

TABLE 1. A COMPARISON OF THE PRINCIPAL MORPHOLOGICAL DIFFERENCES BETWEEN *CAMPANULA SHETLERI* AND *C. PIPERI*

	<i>C. shetleri</i>	<i>C. piperi</i>
Height	To 5 cm	To 10 cm
Indument	Scabrous-hispidulous throughout, the trichomes up to 0.2 mm long.	Finely scabrous-hirtellous in upper portions (calyx-lobes, hypanthium, upper stem and cauline leaves); trichomes less than 0.1 mm long. Rosette leaves glabrous.
Leaves	Short-spatulate, to 1 cm long, dentate with 2 pairs of teeth.	Oblanceolate-spatulate, 1.5-3 cm long, serrate-dentate with 3-6 pairs of teeth.
Calyx-lobes	Narrowly triangular (subulate), 4-6 mm long, entire.	Triangular, 5-10 mm long, occasionally with 1 or more sharp teeth.
Corolla	Pale blue to whitish, about 10 mm long, lobes the same length as or slightly shorter than tube.	Blue (rarely white), 12-16 mm long, lobes almost twice as long as tube.

Trinity Mts. and Mt. Shasta, the latter only 15 air-miles from Castle Crags. Ecologically, it differs from *C. shetleri* in that it grows in spring or streamside sites. Morphologically, *C. wilkinsiana* differs in being a much larger, completely glabrous plant lacking a conspicuous rosette and characterized by obovate to elliptic leaves which are serrate in their upper halves. Moreover, it has deep blue corollas up to 15 mm long terminating stems which are leafless in the upper portion.

The other neighbor, *C. scabrella*, a plant of western Montana to Washington and southward, grows abundantly on Mt. Eddy just 10 air-miles north of Castle Crags. This species, which forms small mats on talus slopes at elevations of 8-9,000 ft., is amply distinct from *C. shetleri* in its entire oblanceolate leaves, herbage with grayish puberulence, and a capsule which opens near the summit.

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